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ABSTRACT

Methods of internal labor market analysis for three organizational areas are presented, along with some evidence about the validity and utility of conceptual descriptions of such markets. The general concept of an internal labor market refers to the process of pricing and allocation of manpower resources with an employing organization and rests upon the hypothesis that these processes within an organization are very different from the external market processes. The three markets analyzed differed in several respects which might be expected to influence internal market characteristics. One market consisted of a single department of a steel company, another the managerial-professional-technical positions in a large insurance company, and the third the manufacturing labor force in a computer and office equipment manufacturer. Application of a Markov model provided empirical characterizations of these markets useful for manpower allocation processes of employing organizations. However, the range of internal labor market characteristics observed among firms raises doubts about the utility of a single conceptual model of this market. (MF)

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13. ABSTRACT

This report describes the empirical investigation of three organizations' internal labor market structures within the framework of the Markov model. The studies reported here provide evidence concerning methods of internal labor market analysis as well as evidence concerning the validity and utility of conceptual descriptions of internal labor markets. The three organizations differed in a number of respects which might be expected to influence internal market characteristics: technology, labor force qualifications, stability of employment, and degree of unionization. Entry ports, mobility clusters, mobility channels and rates of mobility are identified, measured and compared among the three internal markets. The range of characteristics observed among the organizations and over time within a single organization raises doubts concerning the utility of a single conceptual model of the internal labor market. A model relating internal personnel systems to the external product and labor markets probably would have greater analytical utility.

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Internal Labor Markets: An Empirical Investigation

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The general concept of an internal labor market is so well accepted that few have felt it necessary to formalize a model of the concept. The general concept of an internal labor market refers to the processes of pricing and allocation of manpower resources within an employing organization. It appears that the concept developed parallel with the recognition that marginal analysis and competitive market models were not sufficient to explain the pricing and allocation of labor within employing organizations. Most labor market analysis has centered upon the pricing and allocation of labor in markets external to the firm with the often implicit assumption that pricing and allocation processes within the firm were extensions of the external market processes. The concept of an internal labor market rests upon an hypothesis that pricing and allocation processes within an organization are distinctively different from the external market processes.

Recognition of the role of the internal labor market and development of the concept of an internal labor market has grown slowly and usually as a result of interest in some phenomenon explained inadequately by models of external markets. Labor economists concerned with the efficiency of manpower allocation and manpower mobility in the 1950's realized, for example, that analysis of inter-firm and inter-industry mobility does not describe adequately

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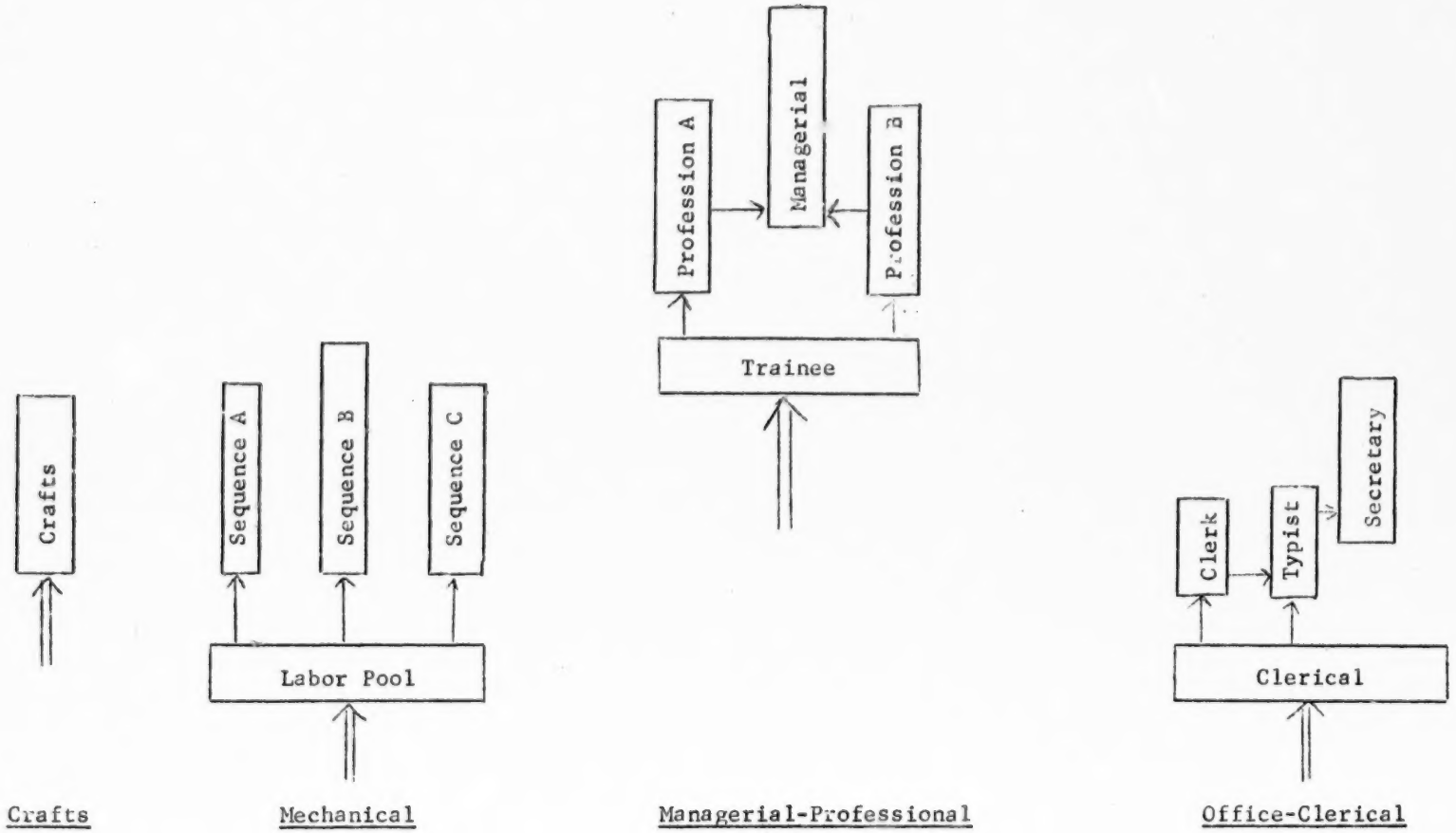
manpower allocation, that most manpower mobility occurs via job changes without severing employment, mobility within the internal labor market.[1] Kerr argued in 1954 that Balkanized labor markets were developing through employer-employee attachments, and that adjustments of manpower allocation would occur increasingly within the confines of the internal labor market.[2] Dunlop elaborated the concept of the internal labor market in his attempts to develop an explanation of job pricing and wage structures.[3] He developed a rationale for job clusters within a firm and the pricing of jobs within a cluster on the basis of considerations internal to the firm; wage rates were linked to the external market, but the pricing process internal to the firm was insulated from external market pressures. Dunlop's model has been elaborated in recent years by Doeringer and Piore, and employed to explain the nature of labor force adjustments to changing demand and employment.[4] They argue that the structure of the internal labor market channels flows of manpower between employment and unemployment and that this structure may account in part for the observed phenomenon of structural unemployment in recent years. Other, more descriptive accounts of internal labor markets are provided by Jennings, Dalton and Packard who present evidence concerning the channels of and criteria for manpower mobility within employing organizations.[5] No one appears to doubt the existence of internal labor markets; the characteristics of the internal labor market, the generalizability of a single model of this market, and the analytical and empirical utility of the model are subject to question, however.

Internal Labor Market Model

The generally accepted model of the internal labor market views the market as an "administrative unit within which the pricing and allocation of labor is governed by a set of administrative rules and procedures" (Dunlop).[6] Jobs within the administrative unit are structured in terms of channels for

manpower mobility and criteria governing this mobility. Manpower is recruited into the firm through specified entry ports or jobs and other jobs are staffed via the rules and procedures for allocating manpower within the internal market. Prescribed channels of mobility link jobs in career channels, and jobs are clustered into sub-markets within which most allocation and mobility is prescribed. An idealized model of the internal labor market is depicted in Diagram 1. Jobs in this market are clustered in four sub-markets: crafts, mechanical, managerial-professional, and office clerical. Manpower is recruited into each of these clusters through a single entry port and, over time, is allocated to one or another career ladder within the job cluster. Points of exchange between career ladders may exist as between clerk and typist, or exchange may occur only through return to the entry port as in the mechanical job cluster where assignments to entry jobs in each career ladder are made from the labor pool. This structuring of jobs in terms of channels of mobility, and the criteria governing mobility, form the essential elements of the general model of the internal labor market.

The general model of the internal labor market holds intuitive appeal and is validated through a variety of institutional evidence. Such evidence includes collective agreements which specify channels of and criteria for manpower mobility and allocation within the employing organization, policies for personnel administration which specify similar internal market structures in the absence of a collective agreement, and experiential evidence provided in accounts of mobility in the internal labor market. The utility of the model depends, however, upon the rigidity of the rules defining mobility channels, sub-market boundaries, and the criteria which govern pricing and allocation. One might argue that the internal labor market structure is an institutionalization of external market criteria and characteristics and a translation of these



Idealized Model of Internal Labor Market

Diagram 1

into non-market terms such as seniority and weighted job evaluation points. In this case, we might expect the internal labor market structure to vary as the characteristics of the external market vary among employing organizations and over time. The internal labor market model then would be useful descriptively, but would provide little analytical or predictive usefulness beyond available market models. Proponents of the internal labor market model such as Dunlop appear to argue that the market structure internal to a firm becomes institutionalized over time and is not responsive to any but major changes in the external market. The internal mobility structure, the structure of wage rate relationships, and the criteria for manpower allocation may at one time have reflected external market conditions, but they have become so institutionalized over time through custom or negotiated agreement, that any change in the structure would alter the rights acquired by employees and is not feasible. Thus, for example, Dunlop argued that manpower adjustments within the firm are accommodated through change in the rates of flow of manpower through the existing structure, not be restructuring entry ports and/or channels of mobility. Others hypothesize that the internal market structure itself is changed in adapting to external market variations.[7]

Propositions concerning the structural characteristics of internal labor markets, determinants of these characteristics, and the stability of the internal labor market structure over time are difficult to assess in the absence of empirical data. Doeringer and Piore describe different types of internal labor markets, enterprise and craft,[8] and discuss structural differences between these market types. Their analyses are based upon reported or inferred market structures, however, and lack empirical verification. Doeringer and Piore suggest that internal labor market structures vary in terms of three characteristics: (1) the degree of openness to the external labor market, e.g. the relative number of points of entry and exit into the internal labor market, (2) the

scope, vertical and horizontal, of internal mobility clusters and the restrictiveness of these clusters, and (3) the rules establishing priorities for internal mobility, e.g. seniority, ability, race or sex. Evidence concerning these characteristics ought be derivable from studies of manpower mobility within firms. Despite Reynolds' observation in 1951, however, there has been little investigation of this topic.

The relatively general, institutional description of internal labor market structures has a more formal analogue in the literature of manpower analysis and planning. Work in manpower analysis and planning has sought to develop formal models of manpower allocation and mobility with applications in forecasting of manpower resource supplies and in simulation of allocation and mobility processes within organizations. One such model, Markov chain model, views manpower mobilities as a probability process over time.[9] The essential characteristics of this model are quite analogous to characteristics of the general concept of the internal labor market, and the model appears to be applicable to the investigation of propositions concerning internal labor market characteristics. Markovian analysis provides a means of characterizing internal labor market structures and thus investigating propositions concerning determinants of and the stability of these structures over time, and also provides a means of exploring the implications of changes in structure for manpower allocation and staffing. We report here evidence concerning internal labor market structures obtained within the framework of the Markov model.

Markov Model of Internal Labor Market

A Markov model depicts movement of elements among different states in a system over time as a probability process. The essential characteristics are a set of exhaustive and non-overlapping states for elements in the process, and probabilities of movement among states during any time interval. The model can

be summarized in the form of a matrix of transition probabilities -- each row i of the matrix indicates a state of location at time 1, each column j indicates a state of location at time 2, and the p_{ij} cell entries indicate the conditional probabilities of movement of an element from state i to state j during the interval between time 1 and time 2. We can apply this conceptual model to the internal labor market by viewing jobs or clusters of closely related jobs as states, manpower as elements in the system assigned to different states, and rates of flow among job states over a time interval as the transition probabilities of the model. Thus, for example, we would model the internal labor market structure of Diagram 1 as indicated in Figure 1. Note that a row (Recruit) and a column (Exit) have been included in the matrix format to complete the model of the market structure. Entry ports into the market are indicated in the Recruit row and exit ports are indicated in the Exit column. Most of the cells in the matrix are empty, reflecting the restricted channels of movement in Diagram 1. The scope of internal mobility clusters is indicated by the clusters of cells with cell entries, the clusters of states among which mobility may occur. The values of the p_{ij} in these cells indicates observed rates of mobility. Priorities for movement among job states do not appear in the simple matrix format but can be investigated through comparison of movers and non-movers or through comparison of Markovian matrices for different employee groups, e.g. males and females. All of the essential characteristics of internal labor market structures suggested by Doeringer, Piore and others thus can be extracted from Markovian models of internal mobility within organizations. Determinants of these characteristics and of change over time might easily be investigated through successive measurement of the market characteristics.

The format for this Markovian analysis was applied in the analysis of three different internal labor markets as a partial test of the applicability

TIME II

TIME I		MGRL	PROF B	PROF A	TRNE	SEC	TYP	CLK	CLER	CRFT	LA C	LA B	LA A	POOL	EXIT
	MGRL	.92	0	0	0										.08
	PROF B	.10	.78	0	0										.12
	PROF A	.06	0	.80	0										.14
	TRAINEE	0	.35	.30	.15										.20
	SEC					.82	0	0	0						.18
	TYPIST					.16	.64	0	0						.20
	CLERK					0	.05	.75	0						.20
	CLERICAL					0	.18	.10	.52						.20
	CRAFT									.92					.08
	LABOR C										.68	0	0	.10	.22
	LABOR B										0	.80	0	0	.20
	LABOR A										0	0	.70	.06	.24
	LABOR POOL										0	.30	.15	.30	.25
	RECRUIT	0	0	0	.14	0	0	0	.25	.01	0	0	0	.60	

Transition Probability Matrix

Figure 1

of the analysis and to investigate the range of variation in market structure characteristics. The method of application in each market was the following:

1) An hypothesized structure of the internal labor market was inferred from collective agreements, personnel policies and job descriptions. Job assignments perceived to be comparable in all respects were grouped together into a single job state in order to restrict the size of the matrix, and to reduce the standard error of estimate of transition probabilities by increasing the number of observations in each state. Job states were ordered in terms of expected progression channels.

2) Transition probabilities among job states were estimated from observed rates of flow of manpower among states during specified time intervals. A time interval for observation was selected in each application such that it would be doubtful that anyone made more than one move during the interval, and yet long enough that observed rates of movement ought be stable over successive time intervals. A time period of six months was applied in the analysis of two markets with a non-exempt labor force, and a time period of one year was applied in the analysis of a market with a managerial and professional labor force. Repeated observations covering six to ten time periods were obtained in the applications.

The three markets analyzed differed in a number of respects which might be expected to influence internal market characteristics: technology, labor force qualifications, stability of product demand and employment, and degree of unionization.

1) One market consisted of a single department of a large firm in the steel industry. The hypothesized market structure paralleled the illustration of Dunlop. The collective agreement of the steel

industry specified quite precisely the entry ports into the departmental market and job sequences for advancement and demotion in reductions of force. The criteria for movement, seniority given ability, also were specified. A very rigidly structured market with restricted entry ports and internal mobility clusters was inferred from the collective agreement. Employment over the total period studied was relatively stable with the exception of a period of reduced demand following increased sales in anticipation of a strike which did not occur.

2) Another market consisted of the managerial-professional-technical positions in a large multiple-line insurance company. This firm has grown to be the largest national underwriter of one of its lines during the last fifty years, and has developed rather structured personnel policies over that time. The hypothesized market structure was characterized by limited entry ports and promotion channels reflecting skill level and functional knowledge. Production and employment increased annually over the period studied, although at varying rates. The mixture of jobs in the market also changed over the period.

3) The third labor market consisted of non-exempt positions of a large computer and office equipment manufacturer. Only the labor force engaged in the manufacture and assembly of computers and related equipment was covered in the analysis. The labor force is not covered by collective agreement, and approximately 40 per cent of the labor force is female. An hypothesized market structure was developed from job descriptions and personnel policies which specify channels of mobility and criteria for mobility. Employment increased six-fold over the six years of study.

Evidence of Labor Market Structures

Labor market structures of the three markets studied are characterized in Figures 2, 3, and 4, matrices of average observed transition probabilities in the three markets. Job states are grouped into internal mobility clusters inferred from the rules and policies governing mobility in each of the markets; job state rows and columns within the clusters are ordered such that cells below the main diagonal indicate promotional moves and cells above the diagonal indicate demotions. Cells not included within the a priori clusters indicate movements which appear to violate the prescribed market structures. The observed rates of flow of manpower in all three markets portray the actual as compared with the prescribed market structure.

Mobility clusters. Mobility clusters are described by Doeringer and Piore as clusters of jobs or job states within which mobility is restricted; manpower shift more readily among these jobs than between jobs within and outside the clusters. In effect, mobility clusters are sub-markets of the internal labor market. The degree to which mobility was restricted to mobility clusters in the three markets in presented in Table 1; this table indicates the average proportion of manpower remaining in a cluster over a time period and the proportion of manpower moving to a job in another cluster during a time period. The rate of movement across cluster boundaries indicates the degree of permeability of these boundaries. The internal mobility cluster boundaries in the three markets reflect both type of skill (occupation) and administrative organization. Each department of the steel firm, for example, is organized as a separate labor market with entry presumably restricted to the labor pool in each department; promotional sequences or mobility clusters within each department reflect skill or occupation. Mobility clusters in the managerial market generally reflect occupational requirements, e.g. accounting, underwriting, claims, etc., although two mobility clusters, Life and Fire, reflect administrative organization.

TIME 2

TIME 1		ADMIN 1	PROF 1	SHIPPING 2 1	CONT ANNEAL 2 1	BLACK PLATE 3 2 1	SALV 1	ASSORT 2 1	ASSORT 2 1	ELECTRO TIN LINE 3 2 1	MISC 1	ELEC 1	MISC 2 1	MECH 2 1	MAINT 1	LABOR 1	EXIT 1
ADMINISTRATION	1	.906	.002			.001 .002		.002	.002	.002 .007							.076
PROFESSIONAL	1	.004	.872		.004	.004							.004			.004	.104
SHIPPING	2 1	.010		.934 .046 .103 .769		.005 .005										.021	.021 .087
CONTINUOUS ANNEAL	2 1	.017	.009		.846 .049 .100 .833	.017 .017 .050					.004 .007			.018 .033	.019	.040	.004 .017
BLACK PLATE	3 2 1	.011 .014		.076	.034	.970 .033 .004 .095 .811 .009 .017 .100 .496	.008	.005			.008		.004	.005 .007		.014 .017	.036 .041 .100
SALVAGE	1	.011		.011		.004	.841			.011						.011	.015
ASSORTING	2 1	.004		.036				.923 .033 .145 .381								.004 .101	.037 .327
ASSORTING	2 1	.023		.014					.895 .023 .009 .001		.023 .006	.014				.040	.035 .131
ELECTROLYTIC TIN LINE	3 2 1	.051				.005			.010 .025	.922 .059 .071 .776 .102 .040 .107			.005	.005	.015	.025	.020 .102
MISCELLANEOUS	1				.012		.006		.006		.856		.006			.015	.036
ELECTRICAL	1	.003										.837					.160
MISCELLANEOUS	2 1	.012			.016	.008				.014	.003		.943 .003 .040 .504	.034	.001 .006		.032 .260
MECHANICAL	2 1				.023					.015			.004 .036	.160 .004 .114 .617		.006	.031 .011
MAINTENANCE	1		.010	.038									.010	.010	.681		.041
LABOR	1		.005		.003	.071	.010	.013	.003	.031	.004	.001	.016	.003 .013		.305	.307
REJECT	1	.043	.057	.002 .023	.002 .002	.007 .014 .045	.014	.002 .045	.027	.043	.041	.100	.002 .006	.005 .034	.004	.414	

TRANSITION PROBABILITY MATRIX - STEEL FIRM

FIGURE 2

TIME 2

TIME 1		LIFE		FIRE			EXEC		TRAINEE	AGENCY		ACTUARY	PERSONNEL	CONTROL	CLAIMS			SERVICE		UNDER-WRITING		ACCOUNT-ING		ADMINIS-TRATIVE		EXIT
		2	1	3	2	1	2	1		2	1				3	2	1	2	1	2	1	2	1	2	1	
LIFE	2	.947	.011	.001							.001											.001				.038
	1	.099	.776									.001		.001		.002						.005				.114
FIRE	3			.948	.014						.004				.001	.002										.031
	2		.001	.063	.829	.002					.001		.001	.001	.001	.008	.001	.001			.001		.001	.001	.001	.089
	1			.005	.229	.313																				.453
EXECUTIVE	2	.002					.955	.006				.009			.004				.002							.022
	1						.027	.922		.002	.002	.011			.002	.002		.002		.003						.030
TRAINEE				.034					.014		.005	.007	.009	.002		.070	.014	.009	.439		.127		.027	.002	.002	.240
AGENCY	2						.031			.937	.003				.001											.027
	1		.001	.001			.001	.001		.055	.850	.001		.006				.004		.001		.004	.004			.069
ACTUARY					.004		.004	.004			.002	.923	.002	.008								.008	.004		.004	.038
PERSONNEL				.002				.012		.002	.002		.926					.002		.002		.005	.002		.042
CONTROL								.003			.011	.003		.892		.003		.005		.003		.005	.011	.003		.063
CLAIMS	3			.002				.001				.001			.935	.014										.039
	2														.031	.795	.019	.001								.151
	1				.006										.005	.088	.800									.097
SERVICE	2						.016			.004		.007	.006		.009			.897	.001		.009	.023	.003			.026
	1		.001		.005		.001	.001		.009	.001	.008	.011		.032	.011		.050	.741		.038	.005	.006	.001	.002	.078
UNDERWRITING	2		.001	.001	.003		.009			.002		.001	.001		.001			.002		.946	.007	.004	.001			.021
	1		.002		.005					.005	.001	.001	.003		.011	.003		.001	.015	.049	.806	.001	.002		.001	.025
ACCOUNTING	2			.003	.001		.011					.001	.001	.003	.001			.006		.004		.869	.073			.024
	1		.001		.003							.004		.015	.003	.001		.003		.004		.080	.796			.091
ADMINISTRATIVE	2		.002		.002		.002				.004			.002		.002							.002	.941	.021	.021
	1				.007									.002	.004			.004		.002				.085	.821	.076
RECRUIT			.030	.01	.06	.01			.03	.01	.02	.01			.47	.17		.04		.08		.05		.01		

TRANSITION PROBABILITY MATRIX - MANAGERIAL MARKET

FIGURE 3

TIME 2

TIME 1		SUPER.		MAINT.		INSPECTION			METAL WORKING				ASSEMBLY						STORES	TECH.			EXIT
		2	1	2	1	3	2	1	4	3	2	1	6	5	4	3	2	1	1	3	2	1	
SUPER.	2	.810	.036																				.153
	1	.056	.819						.002											.004	.004		.115
MAINT.	2		.030	.749	.036				.006	.012										.006		.006	.156
	1			.037	.645						.014	.003					.010	.010	.020				.260
INSPECT.	3		.018			.741	.018			.004						.004				.057	.044	.026	.088
	2		.004			.146	.640	.008			.008								.004		.004	.043	.142
	1					.015	.136	.565			.003					.034	.025	.006	.003			.012	.201
METAL WORKING	4		.032	.005		.009			.689	.018	.005		.009							.027	.014	.018	.174
	3		.009			.027			.186	.513				.009							.018		.239
	2		.011	.022		.011	.006		.071	.093	.505	.016		.006	.006		.006		.016		.016	.027	.187
	1			.006	.056	.006	.017	.006	.040	.017	.181	.232	.006		.006	.045	.028			.017		.017		.322
ASSEMBLY	6		.031	.004		.020	.012	.016	.016		.020	.004	.188	.008	.047	.055	.044		.020	.004	.020	.090	.145
	5		.010	.010			.030				.040		.059	.634		.010					.010	.010	.188
	4		.013	.003		.013	.040			.003	.017		.063	.010	.573	.017					.017	.079	.152
	3		.001		.001	.002	.018	.009	.002	.001	.011	.005	.046	.043	.057	.594	.025	.002	.008	.001	.006	.021	.147
	2			.001	.001		.002	.021			.002	.003	.012	.001	.008	.176	.494	.009	.006			.005	.258
	1						.001	.014			.001		.003	.001		.051	.344	.273	.001		.001	.009	.300
STORES	1		.003	.002	.009	.005	.003	.002			.007	.002	.002			.002			.653			.007	.303
TECH.	3	.002	.021						.001											.819	.005	.004	.148
	2	.003	.021																	.135	.719	.005	.116
	1		.007				.001				.001					.002	.012	.001		.002	.135	.701	.135
RECRUIT		.009	.012	.009	.026	.007	.010	.013	.009	.006	.009	.021	.006	.002	.010	.078	.321	.212	.049	.024	.039	.131	

TRANSITION PROBABILITY MATRIX - COMPUTER FIRM MARKET

FIGURE 4

Table 1

Rate of Mobility from Cluster to Jobs in Other Mobility Clusters

Steel Mill		Managerial		Computer Mfg.	
Administration	.021	Life	.009	Supervisor	.008
Professional	.008	Fire	.014	Maintenance	.059
Shipping	.010	Agency	.231	Inspection	.097
Cont. anneal	.105	Exec	.031	Metal	.133
Black plate	.040		.04	Assembly	.063
Salvage	.068		.03	Stores	.044
Assorting	.010		.047	Technical	.025
Assorting	.058	Claims	.006		
Elec. tin	.045	Service	.094		
Miscellaneous	.030	Underwriting	.042		
Electrician	.003	Accounting	.032		
Miscellaneous	.034	Administration	.019		
Mechanical	.037				
Machinist	.050				
Labor pool	0				
Average	.037		.046		.061
Annual rate	.074		.046		.122

The internal labor market of the steel firm with promotional sequences and seniority criteria for mobility was expected to be more structured in practice than either of the two other markets. Measures of the permeability of internal mobility cluster boundaries presented in Table 1 indicate that these boundaries are least permeable in the managerial market, however. The average rate of movement across mobility cluster boundaries in the managerial market was .046 annually as compared with .037 and .061 semi-annually, or .074 and .122 annually in the steel and computer firms. These relatively low rates of mobility across cluster boundaries indicate that mobility is indeed structured as hypothesized in the internal labor market model, manpower is more readily allocated among jobs within a cluster than to jobs in other clusters. The cluster boundaries are more permeable than suggested in discussions of internal labor markets or inferred from policies to regulate mobility; movement among clusters is prohibited in the collective agreement of the steel firm. Finally, the differences in rates indicates that custom and tradition as in the managerial market can be more restrictive of mobility than contractual provisions as in the steel firm.

Entry ports. The concept of an internal labor market implies restricted entry into the market; manpower are recruited into the market in staffing relatively few jobs, and other jobs are staffed through promotion and mobility of manpower within the market. The relative degree of openness, the proportion of jobs into which someone can be hired, and the stability of the structure of entry ports are matters of opinion and debate. Evidence from the three markets studied provides an interesting picture of variations in the structure of entrance into internal labor markets.

Three characteristics of the entrance structures of the labor markets are summarized in Table 2: 1) degree of openness over the period studied, the mean proportion of job states into which manpower were recruited, 2) variability of

Table 2

Entry Structure Characteristics

	Steel	Managerial	Computer
Openness - mean	.525	.630	.945
range	.24 - .64	.54 - .71	.81 - 1.00
Concentration	.415	.468	.321

openness, the range of openness observed during the periods studied, and 3) concentration of entry, the proportion of recruits entering through the largest single entry port. These measures indicate that entrance into both the managerial market and the steel firm was relatively more structured than entrance into the computer manufacturing firm. Although the collective agreement at the steel firm specified that manpower might be recruited only into the labor pool, we observed manpower entering all but three of the twenty-five job states at one time or another during the six periods of study; on the average, manpower were recruited directly into 52 per cent of the job states, many of them second- or third-level job states in promotional sequences. This .525 degree of openness in the steel firm compares with .630 in the managerial market and .945 in the market of the computer firm. The openness of the labor market of the steel firm was far higher than expected from the union agreement and only slightly less than that of the managerial market; the labor market of the computer firm was so open to exchange with the external market that there is real question whether or not the concept of an internal market has any application in this instance.

The degree of openness varied over time in all three markets, from .24 to .64 in the steel firm, .54 to .71 in the managerial market, and .81 to 1.00 in the computer manufacturing firm. The greatest variability in openness was observed in the steel firm, and it appeared that the degree of openness varied directly with the number of manpower recruited; only six entry ports were used when hiring 29 persons and sixteen entry ports were used when hiring 140 persons.

The third measure of entry structure, concentration, indicates the proportion of recruits flowing through a single entry port. This measure indicates somewhat greater structuring of entrance into the labor markets; 41.5 per cent of recruits into the steel firm, 46.8 per cent of recruits into the managerial market, and 32.1 per cent of recruits into the computer firm entered through a single job state. This aspect of structuring of entrance into the labor markets

reflects both relative size of the different job states and career channeling of entrants; the single most important entry state in each market was the largest job state in the market as well as an entry job state for one or more career channels.

The evidence concerning entry ports into these internal labor markets only partially confirms hypotheses in the literature. The evidence indicates that entrance into the labor markets is somewhat structured, but is by no means as restricted as has been suggested. Openness of the internal market appears to vary considerably among firms as well as over time; the relat vely high degree of openness observed in one market even raises doubt concerning the relevance of the concept of an internal market. Interestingly, entrance into the managerial market which is a product of custom and tradition appears as structured as entrance into the steel firm's market which is rigidly specified in the union agreement.

Every state of an internal labor market is a potential exit port for manpower leaving the firm, and evidence of turnover from every job state in each market was observed. In general, exit or turnover rates varied inversely with the level of the job state within the pay hierarchy of the mobility clusters. This relationship was expected because of the common seniority or tenure requirements for entering the higher paid job states and the usual inverse relationship between turnover and tenure.

Mobility channels. We noted earlier that most of the movement of manpower in each of the three markets was confined to shifts within the mobility clusters; mobility channels tended to be confined to mobility clusters of job states. Mobility channels in the managerial market tended to be most structured. Of the 552 possible shifts among job states in the managerial market, only 31 of these shifts or channels were observed used with a rate $\geq .05$ during one or more periods, less than six per cent of the potential channels; only 20 of these channels

were used at that rate during more than one period. Additionally, 15 of the 20 more frequently used channels adhered to the formally established hierarchy of job states within mobility clusters.

Mobility channels in the market of the steel firm were slightly less structured; 63 of a possible 600 shifts or mobility channels were used with a rate $\geq .05$ during one or more periods (10.5 per cent), and only 35 were used at that rate during more than one period. Nineteen of these 35 more frequently used channels adhered to the formally established hierarchy of job states within mobility clusters.

Mobility channels in the market of the computer manufacturer were least structured; 129 of a possible 420 shifts or mobility channels were used with a rate of $\geq .05$ during one or more periods (30.8 per cent), and 74 were used at that rate during more than one period. Thirty-five of these more frequently used channels were confined within mobility clusters, but only 23 adhered to the established hierarchy of job states; the remaining 12 channels involved moves within the hierarchy which skipped one or more steps of the hierarchy.

Despite numerous counter observations, most of the mobility within these labor markets conformed to the structured mobility channels. The rigidity of this structure of channels varied considerably among the markets in the same manner as observed for other market characteristics, the managerial market appeared most rigidly structured and the market of the computer firm appeared least rigidly structured. In general, the channels for downward mobility corresponded to the channels for upward mobility, with some interesting exceptions in the market of the steel firm. Despite contract provisions for bumping downwards in the promotion sequence, manpower in higher paid job states were observed to leave the firm during times of layoff. These actions were attributed by company officials to a choice of layoff with supplementary unemployment benefits in preference to employment in lower paid jobs. Otherwise, channels for upward and downward mobility tended to be the same.

Stability of the market structure. All of the labor market characteristics were observed over time periods varying from three to ten years as a check on the stability of market structures. We noted earlier that the degree of openness of the structure for entrance varied over time, the proportion of job states into which manpower was recruited increasing with the number of manpower recruited. While the degree of openness varied most in the managerial and steel firm markets, this variation did not alter significantly the pattern of entrance into these markets; 40 to 50 per cent of all manpower recruited into these markets always entered through a single job state. Entrance into the labor market of the computer manufacturer was far less structured and stable; manpower were likely to be recruited through all of the job states, and the proportion recruited through each job state varied significantly from period to period. Increased manpower demands were met in the managerial and steel firm markets by opening additional entry ports and increasing rates of recruitment but maintaining the same relative flows of manpower into the different entry ports; almost all job states served as entry ports in the computer firm and relative flows of manpower into these entry ports varied significantly with manpower needs and availabilities of manpower in the external market.

We noted earlier that channels of mobility within the three markets appeared to be relatively structured and stable over time. While numerous instances of mobility were observed which did not conform to the prescribed structures, these instances did not account for significant proportions of the observed mobility.

Distributions of employment among the different job states over time also were examined for stability in the three markets. The manpower mix or distribution of employment among job states in the steel firm was observed to be relatively constant over the three years of observations; employment in each job state varied directly with total employment in the department, probably because of the fixed skill requirements of the technology employed. Proportional distributions of manpower in the other two markets varied significantly over the

period of study, however, due to changing technologies and product mix in these firms. Computerization of office functions in the insurance firm and changes in product assembly in the computer firm altered significantly the labor force requirements in these two firms.

Stability of rates of mobility within the three markets over time also was examined. One test of stability was accomplished through a test of the constancy of the series of single period matrices of observed mobility rates.[10] Significant results indicating instability of rates of mobility were obtained for the managerial and computer firm markets; the rates of mobility in the steel firm market were found to be stable over time. The instability of mobility rates observed in the managerial and computer firm markets relates to earlier observations about the characteristics of these markets. The labor market of the computer firm has been observed to be relatively unstructured and changing; labor force skill requirements varied, manpower were recruited into all job states, and the distribution of recruits among the job states varied over time. The structure of entry ports and channels of mobility in the managerial market were relatively more structured and mobility rates within this structure were varied over time to allocate manpower as the proportional distribution of the labor force among job states was changed. Entry port structure, mobility channels, rates of mobility and distribution of employment were all relatively stable in the steel firm; mobility rates varied in the managerial market as the distribution of employment changed; and all characteristics of the market of the computer firm varied over time.

The implications of these varying degrees of instability of market structure were investigated by generating manpower projections using a model assuming stability of the market structure and comparing the projections with observed manpower in the three markets. Manpower projections were generated using the following model of a Markov renewal process . . .

$$\left[N_j\right]_{t+n} = \left[N_j\right]_t \left[P_{ij}\right]^n + \sum_{k=t}^{t+n} R_k \left[R_j\right] \left[P_{ij}\right]^{n-(k-t)}$$

where $\left[N_j\right]$ = a manpower distribution vector, the number of persons in each job state j

$\left[P_{ij}\right]$ = a matrix of transition probabilities or rates of mobility among job states

R_k = the number of persons recruited into the market during period k, k = t, ..., t + n

$\left[R_j\right]$ = a manpower recruiting vector, the proportion of recruits to each job state j

The structure of entry into the market, $\left[R_j\right]$, and the channels and rates of mobility within the market, $\left[P_{ij}\right]$, were estimated from three periods of observations and assumed to be constant in projecting to future periods. Projected manpower in each job state was compared with observed manpower in the job state for as many periods as observations were available. Differences between projected and observed manpower are summarized in Table 3 where the differences are expressed in standardized form and compared with an expected distribution of differences.[11] Manpower projections were most accurate in the steel firm where projection errors conformed generally to an expected distribution of errors, and least accurate in the managerial market. Both markets appeared equally structured in terms of entrance to the market and channels of mobility; the only significant difference between the two markets was the degree of stability of rates of mobility and the related stability of distribution of employment.

Criteria for allocation of manpower. Criteria governing the allocation of manpower were investigated in only two markets, that of the steel firm and that of the computer manufacturer. The criteria for allocation specified in the union contract with the steel firm are seniority and ability, the most senior

Table 3

Distribution of occurences of projection errors standardized,

z = (projected n_j - observed n_j) / SD_{nj}

Steel market

expected		1	3	8	8	3	1	
t + 1			1	12	8	4		
t + 2		1	3	7	11	3		
t + 3			3	8	8	5	1	

Managerial market

expected		1	3	8	8	3	1	
t + 1	2			6	8	6	1	
t + 2	2	1	5	2	2	4	2	5
t + 3	2	3	1	2	3	3	2	7
t + 4	5	2		3		1	3	3
t + 5	5	2	3			1	3	9

Computer market

expected		1	3	7	7	3	1	
t + 1	3	2	3	5	4	3		1
t + 2	2	3	6	2	4	2	1	1
t + 3	5	2	4	2	3		3	2
t + 4	5	4	3	2	1	4		2

-3	-2	-1	0	+1	+2	+3

$z = (n_j - n_j) / SD_{nj}$

individual among those qualified for a job shall be entitled to the job. Personnel policies of the computer manufacturer are analogous; job openings are posted and the most senior of the qualified applicants is entitled to the job. The influence of two additional criteria upon allocation, race and sex, were investigated, race in the steel market and sex in the computer manufacturer's market. The influence of these potential criteria was investigated by dividing the labor force of the steel firm on the basis of race and dividing the labor force of the computer manufacturer on the basis of sex and then analyzing and comparing the market structures for each type of employee.

Approximately 56 per cent of the labor force in the steel mill was white, but the proportion of employees in each job state who were white varied from 22 to 93 per cent. Comparison of the structure of entrants to the market indicated that 65 per cent of the non-whites and 57 per cent of the whites entered the labor market through the labor pool, and that seven per cent of the whites and only 0.2 per cent of the non-whites were recruited into the foreman and professional job states. Comparison of the matrices of mobility rates indicated that exit or turnover rates of non-whites were consistently lower than turnover rates of whites. Differential promotion rates also were observed; promotion rates for whites exceeded those for non-whites in two-thirds of the job states, and promotion rates for non-whites exceeded those for whites in one-third of the job states. For whatever reason, the labor market structures for whites and non-whites were clearly different.

Approximately 56 per cent of the labor force in the computer firm was male, but the proportion of employees who were male in each job state varied from 0 to 1.00. Male employees predominated in the highest paid mobility clusters and in the highest paid job states in every mobility cluster. Comparison of the matrices of mobility rates of males and females indicated that the exit or turnover rates of females were consistently lower than turnover rates of males;

promotion rates of males exceeded the promotion rates of females in all but one job state. Again, the labor market structures for males and females were clearly different in this firm.

Summary

The studies reported here provide evidence concerning methods of internal labor market analysis as well as limited evidence concerning the validity and utility of conceptual descriptions of internal labor markets. They indicate, for example, that application of a Markovian model does provide empirical characterizations of internal labor markets useful in the description and analysis of manpower allocation processes of employing organizations. Entry ports, mobility clusters, mobility channels and rates of mobility are easily identified and measured within the framework of the Markov model. These market characteristics provide an empirical basis for corporate manpower planning regarding manpower supplies and flows. Periodic assessment of these measures of market characteristics also provides a basis for control of the manpower allocation processes through identification of manpower policies violated in the allocation processes.

The empirical data provided in these studies is descriptive of the range of internal labor market characteristics which might be found in more extensive analyses. These descriptions indicate that manpower allocation processes within corporations cannot be inferred from personnel policies and union agreements; the manpower allocation processes of the steel firm were surprisingly less structured and the allocation processes of the managerial market surprisingly more structured than one would infer from personnel policies. Our experience suggests that inferential evidence of internal labor market structures is likely to be wrong. Only gross characterizations of the allocation processes can be inferred from policy and collective agreements.

The range of internal labor market characteristics observed among firms and over time raises doubts concerning the utility of a single conceptual model of the internal labor market. A more general model relating internal labor market and the product market probably would have greater analytical utility. This model is yet to be developed. Relevant variables influencing the structure of manpower allocation processes suggested from these studies would include stability of the technology of production, stability of product demand, reliance upon specific or general training, turnover of the labor force, and availability of manpower supplies outside the firm. Custom, tradition and collective bargaining probably also influence the manpower allocation processes, but we would hypothesize that these influences serve more to stabilize market characteristics than to shape them.

REFERENCES

1) L. Reynolds, The Structure of Labor Markets, (New York: Harper, 1951) p. 139.

2) C. Kerr, "The Balkanization of Labor Markets" in E. W. Bakke and others, Labor Mobility and Economic Opportunity, (New York: Wiley, 1954).

3) J. Dunlop, "The Task of Contemporary Wage Theory" in G. W. Taylor and F. C. Pierson, New Concepts in Wage Determination, (New York: McGraw-Hill, 1957), and "Job Vacancy Measures and Economic Analysis" in National Bureau of Economic Research, The Measurement and Interpretation of Job Vacancies, (New York: Columbia University Press, 1966).

4) P. B. Doeringer and M. J. Piore, Internal Labor Markets and Manpower Analysis, (Lexington, Mass.: D. C. Heath, 1971).

5) E. E. Jennings, The Mobile Manager: A Study of the New Generation of Top Executives, (Ann Arbor, Mich.: University of Michigan Bureau of Industrial Relations, 1967); and M. Dalton, Men Who Manage, (New York: Wiley, 1959).

6) J. Dunlop, "Job Vacancy Measures and Economic Analysis," op. cit.

7) See discussions in Work Force Adjustments in Private Industry - Their Implications for Manpower Policy, Manpower Automation Research Monograph No. 7, U.S. Department of Labor, 1968, especially pp. 17-29.

8) Doeringer and Piore, op. cit.

9) See J. Merck, A Markovian Model for Projecting Movements of Personnel Through a System, Personnel Research Laboratory, Lackland AFB, March 1965. Other discussions and applications appear in K. Rowland and M. Sovereign, "Markov Chain Analysis of Internal Labor Supply", Industrial Relations, November, 1969, 88-99; T. Mahoney and G. Milkovich, "The Internal Labor Market as a Stochastic Process" in D. Bartholomew and A. Smith, Manpower and Management Science, English Universities Press (forthcoming).

10) T. Anderson and L. Goodman, "Statistical Inference in Markov Chains", Annals of Mathematical Statistics, 28 (1957), 89-110.

11) We consider the forecast distribution of manpower among the various states a multinomial distribution and calculate the expected standard deviation of observations of number of manpower in each state given the estimated probability of location in that state. See S. Wilks, Mathematical Statistics, (Princeton University Press, 1950), 50-52.

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